The Development of Hyperspectral Cameras - Potato grading and all the light we cannot see.

Bjarke Jørgensen

Newtec Engineering A/S, Odense, Denmark

The intention is to give an introduction to hyperspectral imaging, the various principles for recording hyperspectral images and the physics behind these methods.

Today, farmers and food producers optimize production value by sorting products on parameters such as size, surface quality and weight. This approach unfortunately only reveals information on physical properties of the product, while valuable biochemical information, such as information about sugar-, starch- and amino acid-content, is not considered. Hyperspectral imaging in the Near- and Short wavelength infrared region can reveal this type of information.

Newtec has for more than twenty-five years developed and produced optical sorting machines for potatoes and carrots. However, hyperspectral Imaging is a versatile technique that can be utilized in e.g., biochemistry, heritage science, astronomy, sorting of plastic, geology etc.

Newtec is currently developing snapshot-, push-broom and plan-scanning hyperspectral cameras for Visible/Near infrared/Short wavelength infrared (400-1700nm) and Long wavelength infrared (8-14μm). In particular a Hyperspectral Thermal Camera [1], a Computed Tomography Imaging Spectrometer [2] and the Buteo, a tabletop setup intended for research.

An overview of this instrumentation process is provided along with hyperspectral images of potatoes, comic books, plastic waste, minerals and medieval books while sharing stories of both success and failure.

[1] Jørgensen, A. et al. Surface temperature determination using long range thermal emission spectroscopy based on a first order scanning Fabry-Pérot interferometer, Optics Express, 2022/1/17, 30: p 2186-2196

[2] Huang, W. et al. The application of convolutional neural networks for tomographic reconstruction of hyperspectral images, Displays, 2022/9/1, p 102218